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"AGREEMENT-IN-PRINCIPLE" BETWEEN THE STATE SEISMOLOGICAL BUREAU OF THE PEOPLE'S REPUBLIC OF CHINA AND THE U. S. GEOLOGICAL SURVEY OF THE DEPARTMENT OF THE INTERIOR FOR THE CHINA DIGITAL SEISMOGRAPH NETWORK UNDER ANNEX 1 OF THE PRC-US COOPERATIVE PROTOCOL IN EARTHQUAKE STUDIES

SIGNATORIES

For the:
State Seismological Bureau
People's Republic of China

Gao Wenxue
Deputy Director
May 1983

For the:
Geological Survey
of the Department of the Interior,
United States of America

Dr. Dallas Peck
Director
May 1983

"AGREEMENT-IN-PRINCIPLE" BETWEEN THE STATE SEISMOLOGICAL BUREAU OF THE PRC AND THE U.S. GEOLOGICAL SURVEY FOR THE CHINA DIGITAL SEISMOGRAPH NETWORK UNDER ANNEX 1 OF THE PRC-US COOPERATIVE PROTOCOL IN EARTHQUAKE STUDIES

1. GENERAL

A) The State Seismological Bureau of the PRC is planning to establish the China Digital Seismograph Network (hereinafter referred to as ZSTW) in order to generate a high-quality national seismic data base that will be useful for a variety of research applications; hence, design emphasis will be placed on achieving wide dynamic range and bandwidth, on the validation of the data with respect to timing, calibration, and linearity, and on long-term operational reliability. The purpose of this cooperative project between the State Seismological Bureau and the U.S. Geological Survey (hereinafter referred to as the PRC side and the US side) is to cooperate effectively in design, construction, installation, operation, and maintenance of the ZSTW; to share the network data; and to conduct joint scientific research using the network data. These activities are subject to the continuing availability of funds on both sides.

B) The ZSTW will consist of a network of nine sets of digital seismograph systems, a data management system, and a depot maintenance center. The design of all these systems will be based on a jointly-approved "Instrumentation Plan for the China Digital Seismograph Network" (Appendix 1). The US side will be responsible for implementing the instrumentation plan. Both sides understand that some equipment changes may become desirable or necessary as development progresses. The PRC side will have the opportunity to review any major revisions to the plan that may become necessary during the development phase.

C) In order to facilitate the implementation of the project, both sides agree to combine the procurement of the data system equipment in such a way that each side provides a portion of the equipment for each data system. The equipment to be purchased by the PRC side is listed in Appendix 1, Attachment 2. Within the conditions of paragraph B above, the US side will purchase the equipment listed in the Appendix I, Attachment 1 equipment list except that listed in Appendix I, Attachment 2. For purposes of property management, the PRC side will be providing five of the nine data systems. The cost of the equipment, software, and other necessary initial expenses for the entire project (including the data management system and the depot maintenance center) will be shared about equally.

D) Distribution of US-supplied stations: The four US-supplied stations will be those installed at Beijing, Kunming, Lanzhou, and Mudanjiang. A borehole seismometer will be installed at the Lanzhou station. Mutually acceptable alternate sites may be chosen if the sites listed above are not satisfactory for technical reasons, such as high background noise. Therefore, noise surveys may be conducted at the proposed sites.

E) Sharing of the data: The PRC side will provide the US side with station-tape data on a basically continuous and routine basis from the US-equipped stations, from Urumqi, and from other PRC-equipped stations as may be mutually agreed upon in the future. In addition, the PRC side will provide the US side with copies of ZSTW network day-tapes on a basically continuous and routine basis and, in return, the US side will provide the PRC-side with copies of global network-day tapes. ZSTW data may be provided by either side to the world scientific community.

F) Based on the data that become available from the network, cooperative projects may be established that will involve the development of software and processing techniques, data analysis, and basic research.

2. RESPONSIBILITIES OF THE PRC SIDE

A) The PRC side is responsible for capital construction and preparation of the network facilities for the nine stations (including the US-equipped stations), a data processing center, and a depot maintenance center. This includes, but is not limited to, basic activities such as land purchasing, housing construction, the building of tunnels or vaults, drilling and preparation of the borehole, road construction and repair, power line connections, and supply and preparation of communication facilities.

B) The PRC side will purchase the equivalent of five sets of the digital data systems.

C) The PRC side will purchase the data management system.

D) The PRC side will provide ongoing operation and maintenance of the entire network, including the US-equipped stations, and bear the costs which are necessary to be spent in China.

E) The PRC technical personnel will take part in the development, assembly, and testing of ZSTW components together with US technical personnel.

F) The PRC side will be responsible for providing the US side with station-tape data from the stations as specified in paragraph E, Section 1 within 30 days or sooner if possible after the arrival of the data at the data management center.

G) The PRC side will be responsible for the cost of shipping all equipment purchased by the PRC side.

3. RESPONSIBILITIES OF THE US SIDE

A) The US side will be responsible for designing, developing, testing, and installing a demonstration data system, and the expenses thus incurred will be borne by the US side. The US side will provide manuals, drawings, and other pertinent documentation to the PRC side. This demonstration system will be one of the US-supplied systems. PRC personnel will participate in these activities.

B) The US side will purchase the equivalent of three sets of additional data systems, one of which will be equipped with a KS 36000 borehole seismometer.

C) The US side will be responsible for the cost of equipment and spare parts for the depot maintenance center, according to Appendix I "Instrumentation Plan for the China Digital Seismograph Network".

D) The US side, with some participation of the PRC personnel, will assemble and test the data management system and the digital recording part of the data systems and will support the digital recording part of the data systems for one year of operation in China.

E) The US side will participate in the installation of the data management system, and the US-supplied data systems. US personnel will install, orient, and test the borehole seismometer and instruct PRC personnel in its operation.

F) The US side will provide the PRC side with all software needed for network data review and compilation of the network-day tapes. The software will perform essentially the same functions as the software used at the Albuquerque Seismological Laboratory for processing global digital data. The US side will also render assistance in providing data management software and data processing software, as these may be used at the data management center.

G) The US side will be responsible for providing all spare parts and supplies necessary for routine operation and maintenance of the stations from which station-tape data is sent to the US side. In addition, the US side will furnish enough magnetic tapes to make two copies of the data to be sent to the US side from the PRC side, one copy to be sent to the US and one copy to be retained by the PRC side.

H) The US side will be responsible for the cost of shipping all equipment purchased by the US side.

I) The US side agrees to serve as the contracting agent for the China National Instrument Import and Export Corporation for the procurement of equipment for the Chinese side. The details of this agreement are specified in Appendix 2.

4. IMPLEMENTATION

A) The implementation of this cooperative project will be initiated immediately after the agreement is in effect.

B) The US side will begin immediate development of the demonstration data system. The demonstration data system will be evaluated by both sides and should be ready for installation in China within 12 months.

C) The US side will assist the PRC side in starting immediate procurement of the data management system (DMS) and when delivery dates are firm, the US side will contract for development of the DMS software. The DMS should be available for installation in China within 11 months.

D) The PRC side and the US side will initiate procurement of equipment for the data systems and the depot maintenance center according to the mutually-agreed upon instrumentation plan, so as to have the entire network installed and operational within approximately 24 months.

E) The demonstration system, the data management system, and the digital recorders will be assembled and tested at the Albuquerque Seismological Laboratory, but the final assembly and testing of the complete data systems will be performed in China.

F) The schedule of the PRC personnel training and participation will take place after contracts have been awarded for the demonstration system and data management system and firm delivery dates are known.

APPENDIX 1

TO THE

AGREEMENT FOR A CHINA DIGITAL SEISMOGRAPH NETWORK

UNDER ANNEX 1 OF THE PRC-US COOPERATIVE PROTOCOL

IN EARTHQUAKE STUDIES

INSTRUMENTATION PLAN
FOR THE
CHINA DIGITAL SEISMOGRAPH NETWORK

MAY 1983

INTRODUCTION

This plan describes the instrumentation proposed for a China Digital Seismograph Network (hereinafter referred to as ZSTW). The data systems used in the network will be developed jointly by the State Seismological Bureau (SSB) of the People's Republic of China (PRC) and the U.S. Geological Survey (USGS). The purpose of the ZSTW is to generate high-quality seismic data that will be useful for a variety of research applications; hence, design emphasis will be placed on achieving wide dynamic range and bandwidth, on the validation of the data with respect to calibration, timing, and linearity, and on long-term operational reliability.

The ZSTW will consist of digital seismograph systems installed at new or existing stations in China, a data management system that will be used to review the station data and compile network day tapes, and the support facilities needed to insure continuous operation of the network. In order to take advantage of proven technology and lessen development risk, the instrumentation proposed in this plan is based to a large extent on existing hardware and software used by the USGS in the global digital seismograph network (GDSN). For example, the digital recording system used in the digital World-Wide Standardized Seismograph Network (DWWSSN) is proposed for use in the ZSTW systems, and the data management system will be modeled on the USGS data management system used to compile GDSN network day tapes. However, modifications to the existing systems are proposed where improvements can be made without significant risk or added cost.

DATA SYSTEM

General

The major components of the proposed ZSTW data system are shown in Figure 1. All of the major elements of the system (except the automatic calibrator) are available from commercial sources and most of the components have been previously used or tested in USGS seismic systems; hence, development risk is low. However, it will be necessary to assemble and test a prototype version of the system to insure that components are interfaced properly and that proposed modifications to existing hardware and software function as planned. The assembly and test of a prototype ZSTW system is expected to take six to nine months.

Data Bands

The overlapping data bands shown in Figures 2 and 3 are proposed for recording on the ZSTW system. The final transfer characteristics may differ slightly depending on filter design and it may be desirable to adjust some of the recording sensitivities for varying site conditions, but the curves are adequate for defining the types of data to be recorded. The short-period (SP) and long-period (LP) channels will have adequate sensitivities for resolving body-wave and surface-wave signals at earth background levels at quiet sites. The broadband (BB) channel will be set to a lower sensitivity; it is intended for broadband recording of moderate to large body-wave signals and for increasing the effective recording range in the SP and LP bands.

Sampling rates proposed for the data bands recorded on the ZSTW system are as follows:

SP	40 samples/second
BB	20 samples/second
LP	1 sample/second

During normal operation, the LP signals will be recorded continuously and the recording of the SP and BB signals will be triggered by event detectors. However, other recording modes will be available, including fulltime recording of any of the signals at the option of the operator.

Sensor Systems

Short-period signals will be derived from a triaxial set of PRC-supplied Model DJ-1 seismometers. The Teledyne-Geotech S-13 seismometer is an alternate. In either case, amplifiers will be needed to boost the signal level to 60,000 volt-seconds per meter at the input to the analog-to-digital converter (ADC). A modified and repackaged version of the Teledyne-Geotech Model 43310 FET-input amplifier will be used. Because of the high circuit resistances, adequate RFI and EMI shielding and short seismometer to amplifier signal lines will be necessary.

Streckeisen Modél STS-1 broadband seismometers will be used to generate both the BB and LP signals. They have a high clipping threshold (a specified dynamic range of 140 dB), a high signal output, and they are equipped with protective enclosures to isolate the sensors from ambient pressure and temperature fluctuations. Electronics furnished with the STS-1 seismometers provide signal amplification and filtering. The seismometers are force-balance sensors having closed-loop periods of 20 seconds. BB signals are derived from the velocity output of the seismometer and LP signals are derived from the acceleration (mass-position) output. The STS seismometers are equipped with calibration coils.

One of the US-supplied ZSTW systems will be equipped with a KS 36000-01 borehole seismometer identical to the type being used at the Seismic Research Observatories. The borehole sensor system includes the seismometer, a winch and mast assembly for installation and retrieval, and the uphole electronics needed for leveling, calibration, and signal conditioning. The seismometer is designed for installation at a depth of 100 meters in rock. The long-period signals generated by the borehole seismometer will be recorded in place of the STS long-period signals. However, the STS seismometers will be installed at the station to generate the BB signals and to serve as a backup for LP recording. The borehole seismometer will provide high-resolution horizontal-component long-period data regardless of surface wind conditions.

Digital Recording System

The digital recording system will consist of an ADC assembly, a microprocessor assembly, and a tape drive assembly. The ADC assembly includes a 16-channel multiplexer (MUX), a 16-bit ADC, and a digital-to-analog converter (DAC). The

analog signals, having peak values of 10 volts, are sampled sequentially by the MUX, then converted to 16-bit digital data words by the ADC. A floating-point data word format will be used that will provide 78 dB of resolution and 42 dB of gain ranging for a total recording range of 120 dB (14-bit resolution with sign and 2 bits used to specify gain steps of 1, 8, 32, and 128). The additional recording range is an advantage when it is important to record a wide range of signal amplitudes, as it is in this case. The DAC is used to convert digital data back to analog data, principally for purposes of test and signal monitoring.

System control and recording functions, including event detection, reside in the software of the microprocessor assembly. This assembly will consist of three microprocessors and at least 16 kilobytes of random access memory (RAM). The microprocessors contain the operating software for controlling the ADC, event detection, and data formatting. The software is written on programmable read-only memories (PROMS); the programs can be replaced or modified by replacing the PROMS, which are mounted on plug-in sockets. The RAM serves as a buffer in formatting the data records prior to recording and for storing pre-event SP and BB data.

The tape drive assembly will consist of a formatter and two tape drives. The high-capacity cartridges will each store 67 megabytes of formatted data. On the average (assuming fulltime LP recording, 10% recording time for BB data, and 5% recording time for SP data), each station will produce 2.6 megabytes of data each day; therefore, a cartridge will store about 25 days of data. However, tape cartridges will be changed on a weekly or biweekly basis. The second tape drive will insure that data are not lost during tape changes or during a failure. The data are formatted into records. The first 20 bytes of a record, called a header, contain information and the remaining bytes in the record contain data. There are separate records for the SP, BB, and LP data. Vertical, north, and east components are multiplexed into each record in that order. The record header will contain a station identification code, sampling rate, time of year to the nearest 10 milliseconds, number of channels being recorded, eight flag bits, event detection parameters, and an unspecified block of six bytes. Flag bits are used to indicate that calibration is in progress, that analog signals are saturated, and other state-of-health information.

A hard copy terminal will be provided with the recording system. The terminal will be used by the station operator to control system operation and to print out event parameters generated by the event detector.

Analog Recording System

A visual drum recorder will be furnished with each ZSTW system. Analog signals for the recorder will be derived from the DAC, which can be switched to monitor any of the digitized signals. The recorder is useful for verifying system operation, for setting sensitivities during initial calibration, and for adjusting event detection parameters. In routine day-to-day operations, the recorder may be used to continuously record any channel selected by the operator. In addition, analog output signals will be available from all of the SP, BB, and LP amplifiers and may be recorded continuously on analog recorders provided by the station.

Station Clock

Station time will be generated by a Systron-Donner Model 8110 digital clock. It is accurate (oscillator stability of 4 parts in 10^9 per day) and has demonstrated reliability. The clock will generate a time code for analog records as well as a digital time code to be recorded on tape. A True-Time WVTR radio time code receiver will be provided for measurement and adjustment of clock errors.

Event Detection

The ZSTW system operating software will include an event detector to trigger recording of SP and BB signals. Although a single algorithm will be used, separately programmable turn-on and turn-off parameters will be available for the SP and BB channels. Sufficient buffering will be provided so that at least 16.5 seconds of SP and 33 seconds of BB pre-event data will be recorded. Recording will be retriggered if turn-off conditions are not satisfied. A new event detection algorithm has been developed and tested at the Albuquerque Seismological Laboratory (ASL). It is effective in detecting events and, in addition, it computes event parameters (time of arrivals, sense of first motion, period and amplitude of the first several cycles). The event parameters will be printed out automatically on the hard copy terminal.

Calibration

The ZSTW system will include an automatic calibrator that will produce both step function and sine-wave calibration signals that can be applied to the short-period and broad-band seismometers. The sine wave will be synthesized at selectable frequencies from a program stored on a PROM. During installation and periodically thereafter, the sensor systems will be fully calibrated. Seismometer parameters will be adjusted, calibration constants will be measured, and the sine wave calibration will be applied over suitable bands to validate the system transfer function. Daily calibration, needed as a check of stability, will consist of a single sine wave or a step function applied automatically to the short-period and broadband sensor systems. The calibration will be inhibited if event recording is in progress. The onset time of the calibration signals will be precisely synchronized so that phase delay can be computed to within a sampling interval. Calibration flags will be set in the record headers when calibrations are applied.

Power Subsystem

The AC power requirement of a ZSTW system is expected to be about 500 watts, but a considerably larger capacity power subsystem is recommended to improve reliability and to provide reserve for future expansion. An uninterruptible power system (UPS) will be needed to insure continuous operation in the event of temporary line power failure. The UPS will consist of a voltage regulator, a 60-ampere battery charger, a set of twelve 250 ampere-hour 24-volt lead acid batteries, and a 1.5 KVA inverter. Lead-calcium batteries have a longer-life, but lead-acid batteries are more practical for China as they are easier to replace. Input to the UPS will be a nominal 220 VAC at 50 Hz; output will be regulated 120 VAC at 60 Hz. The regulator (stabiline EMT 4220) will handle fluctuations ranging from 195 to 255 volts. A 6.5 KW back-up generator is recommended for any site where power outages are frequent and of relatively

long duration (several hours per day or more).

Manning and Facility Requirements

The ZSTW systems will be designed for operation at manned observatories. Weekly servicing intervals are feasible, but normally the ZSTW systems should be serviced on a daily basis. This will only require a few minutes. Analog records will be changed and clock error will be checked. Clock errors and corrections, operational anomalies, and any maintenance performed will be noted on a station log. A copy of the station log will accompany each tape sent to the processing center.

The physical configuration of the system will depend on the station layout. Normally, the sensor systems (seismometers and amplifiers) will be installed in a vault, preferably underground with the pier or floor attached to competent rock. The sensor systems will not require frequent maintenance. The seismometers will need pier or floor space of about 1.5 square meters. The distance between the sensor systems and the recording system can be several hundred meters if necessary. However, any outside cabling should be installed underground in conduit. The recording system will be contained in one or two standard 19" racks. The racks, plus adjoining work area, will require a space of about 9 square meters. This space must be cooled if the temperature is expected to exceed 30^{o} C and heated if the temperature is expected to drop below 15^{o} C. The UPS batteries should be installed in a separate, well-ventilated enclosure that can be heated in winter.

A borehole will be required at the site selected for the KS 36000 borehole seismometer. The borehole should be drilled to a depth of 100 meters or more in rock, discounting unconsolidated overburden. It will be cased with standard 7-inch oil well casing, cemented, and adequately plugged to prevent ground water intrusion. Detailed specifications for the borehole will be provided.

DATA MANAGEMENT SYSTEM

A Data Management System (DMS) is an essential component of the ZSTW. It is needed for monitoring data quality (since tapes are not normally read at the individual stations) and for organizing the data into a standardized data base that is convenient for the use of research scientists. Although there has been considerable progress in the development of mass storage devices, a tape-based DMS (one that uses tape for data distribution and archiving) is the most practical for the ZSTW. The DMS will also support data analysis and research to a limited extent.

There are advantages in using the ASL GDSN data management system as a model for developing the ZSTW DMS. Tapes collected from the GDSN network stations are first passed through an automated review process that detects errors in timing, parity, and header information. These defects are repaired. Segments of the data are checked visually for data quality and selected segments are spectrally analyzed to monitor background noise levels. Following initial review, the station data are placed on a large disk having the capacity to store several weeks of network data. Calibration checks are made as the data enter the disk by at least-square fitting of calibration signals. The computer outputs error messages if calibration is not within proper

tolerance. When data from all stations are on the disk for concurrent days, the operator writes network day tapes. The day tapes contain 26 hours of data organized by station and component. In addition to the data, the day tapes contain the essential information needed for analysis (station coordinates, timing errors, transfer functions) so that processing can be fully automated. The tapes also contain comments concerning the status of stations and individual components. The GDSN network day tape format has been proposed as the standard for international exchange of seismic data. The USGS has developed and is distributing a package of FORTRAN programs useful for reading and processing day tapes.

The block diagram in Figure 4 shows the minimum configuration hardware needed for compiling day tapes from a network of 10-15 stations. Most of the mainframe equipment is available from the Digital Equipment Corporation (DEC). Purchase of the mainframe equipment from a single supplier is recommended as this assures proper interfacing and will simplify maintenance. The PDP 11/44 processor is the most recent 16-bit machine manufactured by DEC. Direct memory is expandable from a minimum of 256 kilobytes to a maximum of 1 megabyte proposed for this system. It has 8 kilobytes of cache memory and will support 8 terminals plus the control console. The minimal configuration system as shown includes two 1600 bpi tape drives; a third tape drive is recommended as this will enhance reliability of day tape operations and support off-line research. The system disk configuration consists of two DEC 10-megabyte disk drives. Each disk stores its data on one removable cartridge, which provides a convenient method of system backup. If one disk drive fails, the computer can operate satisfactorily on the remaining drive. For storing network data, a high capacity disk drive will be needed. A disk capacity of about 400 megabytes is recommended. Two CRT terminals (Tektronix type recommended) with graphics capability will be needed for displaying the seismic waveforms. A hard copy unit will be attached. A separate digital plotter is also recommended. Additional terminals can be added. A power backup system is required; it should have sufficient capacity to run the computer long enough to enable an orderly shutdown in event of a power failure.

The GDSN data management system uses the UNIX operating system and this is proposed for the ZSTW DMS as UNIX is more efficient for large file management than the DEC operating system. The GDSN day tape software can be modified for use on the ZSTW DMS. The software was developed by Lisle Computer Corporation of Albuquerque, New Mexico and this firm is recommended as the supplier of software for the ZSTW DMS.

A high level of training for the computer system operators will be essential. At least two personnel should be trained in hardware operation and maintenance and two in software. A specific training program will be recommended.

NETWORK MAINTENANCE AND SUPPORT

Resources will have to be appropriated at the outset to support the ZSTW. There will be a need for local maintenance at the individual stations and for a central depot maintenance facility located near the data processing facility. Spare parts will be furnished with each system, the type and quantity to be determined during system design. Two technicians at each

station should receive the level of training needed to operate and service the ZSTW system. This training, perhaps three weeks in duration, can be provided by PRC engineers during installation of the new system. However, a two-week familiarization course in Beijing for all station operators prior to installation of the systems would be useful.

The depot maintenance facility should have the capability to isolate and repair equipment to the circuit component level. The inventory should include parts, boards, modules, IC testing devices and other equipment, plus a complete digital recording system that will be used for training and for testing repaired components. Direct, rapid communication between the depot and stations will be important. The depot should be located close to the DMS (ideally in the same building) as there will be a continuous interchange of information between the two groups. Direct Telex communication between ZSTW headquarters in Beijing and the Albuquerque Seismological Laboratory will be very useful, especially during the early stages of the program. PRC engineers and technicians responsible for network-wide support should receive training in the U.S. and participate in final assembly and testing of the prototype system. Additional training will be provided by USGS engineers during the installation of the demonstration system in China.

ATTACHMENT 1

TO

INSTRUMENTATION PLAN

FOR THE

CHINA DIGITAL SEISMOGRAPH NETWORK

EQUIPMENT LISTS

MAY 1983

This attachment contains proposed equipment lists for the ZSTW data systems, data management system, and depot maintenance center. Some changes may become necessary or desirable as development progresses. The cost estimates are subject to change; firm costs will not be available until contracts are negotiated with individual suppliers.

DATA SYSTEM EQUIPMENT LIST

Item	Supplier	Model	Quantity	Estimated Cost
Broadband Seismograph System	Streckeisen	STS-1	1	US$ 27,000
Short-Period Seismometers	PRC	DJ-1	3	3,000
Short-Period Amplifier/Filter Unit	Teledyne-Geotech	433310 modified	1	9,000
Calibrator	Assorted		1	3,150
Radio Receiver w/antenna	True-Time	WVTR	1	1,390
Helicorder	Teledyne-Geotech	RV-301B	1	2,840
Helicorder Amplifier	Teledyne-Geotech	AR-320	1	580
Digital Clock	Systron-Donner	8110	1	7,800
Analog-to-Digital Converter	Phoenix Data	7115 special	1	8,400
Microprocessor	Intel	ISBC 86/14	1	3,200
Microprocessor	Intel	ISBC 80/24	2	2,600
Microprocessor Chassis & Power	Intel	ISBC 660	1	2,100
Tape Drive Assembly w/Formatter	3M	HCD-75	1	2,800
Second Tape Drive	3M	HCD-75	1	1,160
Terminal	Data General	TP-1	1	2,100
Voltage Regulator	Stabiline	EMT4220	1	2,140
UPS Charger	La Marche	A11-60-24V	1	1,890
UPS Inverter	La Marche	A51-1.5K-24V	1	2,770
Batteries	Exide	24 V, 250 AH	12	1,660
Standby Generator	PRC	6.5KW	1	2,630
Racks and Enclosures	Assorted			3,150
Cabling and Hardware	Assorted			2,100
Lab Tool Kit	Jensen	JTK-27/37W	1	1,310
Operating Supplies (one year)	Assorted			1,500
Spare Parts	Assorted			1,490
				$ 97,760

DEPOT EQUIPMENT LIST

Item	Supplier	Model	Quantity	Estimated Cost
Test & Training System (one complete CDSN data system)				US$ 97,760
Microprocessor Tester	Fluck	9010A	1	7,350
ADC Tester	USGS			1,050
System Analyzer	Millenium	2000+options	1	11,350
Multimeter	Beckman	3030	2	530
Oscilloscope, dual trace	Tektronix	2445	2	6,480
IC Tester	Hytronic	Myriad/XK	1	6,300
Voltage Standard	Analogic	An3100-U-X	1	900
Strip Chart Recorder	MFE	M20	1	840
Function Generator	Wavetek	185	1	950
Multifunction Counter	Fluke	1912	1	900
Lab Tool Kit	Jensen	JTK-27/37W	2	2,620
Digital Clock	Systron-Donner	8110	1	7,350
Helicorder Amplifier	Teledyne-Geotech	AR-320	1	660
Analog-to-Digital Converter	Phoenix Data	7115 special	1	8,400
Tape Drive	3M	HCD-75	1	1,700
Tape Drive Formatter	3M	HCD-75	1	2,100
Microprocessor	Intel	ISBC 80/24	4	5,200
Microprocessor	Intel	ISBC 86/14	2	6,400
Assorted Spare Parts				4,500
Assorted ICs				7,500
				$ 180,840

The Chinese side proposes that the US side give consideration to purchase the following additional equipment:

Oscilloscope, digital storage	Nicolet	2090+options	1	8,400
Digital Playback System (for HCD-75)	USGS		1	
Sensor Test & Control Unit	Streckeisen		2	2,300

DATA MANAGEMENT SYSTEM EQUIPMENT LIST

Item	Supplier	Model	Quantity	Estimated Cost
Central Processing Unit w/1 mb memory	DEC	PDP 11/44	1	US$ 28,900
Disk Memory & Controller, 10 mb	DEC	RL-211-Ak	1	6,040
Disk Memory Cartridge, 10 mb	DEC	R102-Ak	1	2,630
Removable-Media Disk, 410 mb	DEC	RA 60	1	33,000
Magnetic Tape Drive w/controller, 45 ips, 1600 bpi	DEC	Ts-11-CA	2	28,800
Floating Point Processor	DEC	Fp 11-F	1	2,720
Terminal Interface, 8 channel, RS-232	DEC	DZ 11	1	3,810
Paper Terminal, 180 cps	DEC	LA 120-DA	2	4,910
Terminal Cable	DEC	BC03M-A0	2	280
Backplane	DEC	DD11-DK	1	830
Paper Tape Reader	DEC	PMK01-BA	1	2,310
Cabinet for Disk Drive	DEC	H9642-BD	1	1,570
*Display Terminal	Tektronix	4012	1	5,365
Hard Copy Unit	Tektronix	4611	1	3,940
Digital Plotter	Zeta	8	1	5,950
Oscilloscope	Tektronix	2445	1	3,240
Multimeter	Beckman	3030	1	260
Lab Tool Kit	Jensen	JTK-27/37W	1	1,310
Tape Cleaner	Computer Link	1022-1	1	4,340
Terminal Paper			40 cartons	840
Magnetic Tape, 2400 ft, 10.5 inch			400 reels	4,460
*UPS Power Subsystem w/batt	La Marche	8 KVA	1	24,000
HCD-75 Tape Drive, two with interface	SCI		1	9,000
Spare Parts (list to be provided by DEC)				50,000
Flatbed Digital Plotter	Tektronix	4662	1	4,110
Tape Storage Rack, 300 reel	Tab Products		1	2,240
Display Terminal w/32k memory	Tektronix	4112	1	8,840
				US$243,695

ATTACHMENT 2

TO THE

INSTRUMENTATION PLAN FOR THE

CHINA DIGITAL SEISMOGRAPH NETWORK

PRC EQUIPMENT PURCHASE LIST

MAY 1983

Item	Supplier	Model	Quantity	Estimated Cost
Data Management System, less HCD-75 Interface				US$ 234,695
*Broadband Seismograph System	Streckeisen	STS	10	270,000
Short-Period Seismometers	PRC	DJ-1	30	30,000
Helicorder	Teledyne-Geotech	RV301B	10	28,400
Helicorder Amplifier	Teledyne-Geotech	AR-320	11	6,380
UPS Charger	La Marche	A11-60-24	10	18,900
UPS Inverter	La Marche	A51-1.5K-24	10	27,700
Standby Generator	PRC	6.5KW	10	26,300
Digital Clock	Systron-Donner	8110+options	11	85,800
Function Generator	Wavetek	185	1	950
Multifunction Counter	Fluke	1912	1	900
Strip Chart Recorder	MFE	M20	1	840
Voltage Standard	Analogic	AN3100-U-X	1	900
Multimeter	Beckman	3030	2	530
				$ 732,295

*Item to be purchased directly from supplier with delivery to Beijing

"AGREEMENT IN PRINCIPLE" BETWEEN THE U.S. GEOLOGICAL SURVEY,

THE CHINA NATIONAL INSTRUMENT IMPORT AND EXPORT CORPORATION (CIIEC),

AND THE PRC STATE SEISMOLOGICAL BUREAU

FOR THE PROCUREMENT METHOD OF EQUIPMENT FOR THE

CHINA DIGITAL SEISMOGRAPH NETWORK

APPENDIX 2

AGREEMENT NO. 83FXM-558017MR

"Agreement-In-Principle" between the U. S. Geological Survey of the Department of the Interior, U.S.A. (USGS) and China National Instruments Import and Export Corporation (CIIEC) for the procurement method of equipment for the China Digital Seismograph Network.

I. General

The U.S. Geological Survey (USGS) and the PRC State Seismological Bureau (SSB) are engaged in a cooperative program to develop, install, and operate a China Digital Seismograph Network. This work is being performed under US-PRC-Co-operative Protocol in earthquake studies. Under the Agreement, both the USGS and the SSB are responsible for the purchase of equipment that will be used in the Network. Since much of the equipment to be purchased by both sides is identical, there will be cost savings and other advantages in purchasing the equipment jointly under single contracts with individual suppliers. Therefore, the USGS proposes to serve as the Contracting Agent for the China National Instruments Import and Export Corporation (CIIEC).
The estimated cost of the equipm[illegible] is contained in a list attached to this agreement. These estimates are [illegible]ect to change; firm costs will not be available until contracts have been negotiated with suppliers.

II. Packing

To be packed in strong wooden cases or cartons, suitable for long distance air freight transportation and to change of climate, well protected against moisture and shocks. The USGS shall be liable for any damage of the equipment and expenses incurred on account of improper packing and for any rust attributable to inadequate or improper protective measures taken by the USGS in regard to the packing.

III. Shipping Mark

The USGS shall mark on each package with fadeless paint the package number, gross weight, net weight, measurement and the wordings: "KEEP AWAY FROM MOISTURE" "THIS SIDE UP", etc. and the shipping mark: 83FXM-558017MR
BEIJING/CHINA

IV. Time of Shipment

Before the end of May 1985 (Estimated), partial shipment allowed.

V. Port of Shipment

Albuquerque Airport, New Mexico, USA

VI. Port of Destination

Beijing, China

VII. Insurance

To be covered by CIIEC after shipment.

VIII. Shipment

The USGS shall deliver the equipment to Beijing, China by air freight through the freight forwarder - China Interocean Transport Inc. (1 World Trade Center, Suite 5371, New York, New York 10048, USA. Telephone: 212-524 9060) with the actual air freight charges to be prepaid and added to the invoice for reimbursement by the CIIEC and will advise CIIEC by telex of the equipment; quantity, value, number of packages and gross weight immediately after dispatch of the equipment.

IX. Responsibilities of the USGS

The USGS will undertake the following tasks:

1. Prepare specifications for the equipment and services.
2. Contract with individual suppliers for equipment and services using established U. S. Government procedures; negotiated prices for all contracts exceeding US$10,000 will be furnished for CIIEC for confirmation before the contracts are officially awarded.
3. Take delivery and perform all necessary acceptance testing of the equipment.
4. Arrange for export licensing.
5. Prepare the equipment for shipment and arrange for shipment of the equipment to Beijing, China.
6. The USGS will provide copies of all contracts, purchase orders and other financial documents to CIIEC for payment.

X. Payment

CIIEC shall open an irrevocable letter of credit with Bank of China, Beijing through the American Security Bank (1501 Pennsylvania Avenue, N.W., Washington, D.C. 20013, USA), in favour of the U.S. Geological Survey of the Department of the Interior, U.S.A. for the total value of purchased equipment estimated US$468,594.50. The amount includes funds provided by the CIIEC to the USGS for administrative costs, computed at a rate of 10%. The credit shall be available against the USGS's drafts (bill for collection) drawn at sight on the opening bank for 100% of the invoice value accompanied by the following documents:

1. 5 copies of original supplier's invoices which include specifications, quantity, unit price and total price.
2. 2 copies of original supplier's packing lists.
3. 1 copy of original manufacturer's certificate of quality.
4. 1 copy of original equipment receipt issued by the USGS to include 10% administrative costs.

Payment shall be effected by the opening bank by telegraphic transfer against presentation to them of the aforesaid drafts and documents at the end of every third month. The letter of credit shall be valid until the 30th day after the final shipment from Albuquerque to Beijing is effected. The USGS will notify CIIEC by telex on the date of the final shipment.

The CIIEC will be responsible for air freight charges from Albuquerque, New Mexico, USA to Beijing, China based on the total weight of the equipment under this agreement. Payment for freight charges shall be effected by the CIIEC, by telegraphic transfer, within seven days after receipt from the USGS of 5 copies of invoices and one original and two copies of airway bill marked "Freight Prepaid" and consigned to the China National Foreign Trade Transportation Corporation at the airport of destination notifying the CIIEC.

Agreement No. 83FXM-558017MR should be marked on every document mentioned above.

The USGS will guarantee to make shipment of the equipment under this agreement within approximately 24 months from the date of this agreement.

XI. Implementation

This agreement shall enter into force upon signature by the USGS and the CIIEC and shall remain in force for the duration of the Protocol for Scientific and Technical Cooperation in Earthquake Studies.

SIGNATORIES

For The:

China National Instruments
Import & Export Corporation
(Xi Jiao, Er Ligou, Beijing, China
Telex: 22304 CIIEC CN)

Han Li Fu
Deputy Managing Director
May 13, 1983

Zhang Shu Kuan
Vice Manager of the 4th Import
Department
May 13, 1983

For The:

Geological Survey
of the Department of the Interio
United States of America
(Sunrise Valley Drive, National
Center, Stop 905, Reston, Va. 22
U.S.A.)

Dr. Dallas Peck
Director
May 13, 1983

ATTACHMENT TO AGREEMENT NO. [illegible]

ITEM	SUPPLIER	DESCRIPTION	QTY	UNIT PRICE	TOTAL
1	DEC	Data Management System excluding HID-75 Interface, details as per the attachment hereto.			US$234,695
2	Geotech Teledyne	Helicorder Model RV301B	10		28,400
3	"	Helicorder Amplifier Model AR-320	11		6,380
4	La Marche	UPS Charger A11 - 60 -24	10		18,900
5	"	UPS Inverter A51-1.5K-24	10		27,700
6	Systron-Donner	Digital Clock Model 8110	11		65,800
7	Wavetex	Function Generator Model 185	1		950
8	Fluke	Malfunction Counter Model 1912	1		900
9	MFE	Strip Chart Recorder Model M20	1		840
10	Analogic	Voltage Standard AN3100-U-X	1		900
11	Beckman	Multimeter Model 3030	2		530
					US$405,995
		Plus Estimated packing charges:			20,000
					425,995
		Plus 10% Administrative Cost			42,599
		Total Estimated FOB Albuquerque, New Mexico (Assembly Point) incl. packing charges:			US$ 468,594

ITEM	SUPPLIER	MODEL	QTY	EST. TOTAL
Cent. rocessing Unit w/1 mb memory	DEC	PDP 11/44	1	US$28,300
Disk Memory & Controller, 10 mb	DEC	RL-211-AK	1	6,040
Disk Memory Cartridge, 10 mb	DEC	RL02-AK	1	2,630
Removable-Media Disk, 410 mb	DEC	RA 60	1	33,000
Magnetic Tape Drive w/controller, 45 ips, 1600 bpi	DEC	TS-11-CA	2	28,800
Floating Point Processor	DEC	FP 11-F	1	2,720
Terminal Interface, 8 Channel, RS-232	DEC	DZ 11	1	3,810
Paper Terminal, 180 cps	DEC	LA 120-DA	2	4,910
Terminal Cable	DEC	BC03M-A0	2	280
Backplane	DEC	DD11-DK	1	830
Paper Tape Reader	DEC	PNK01-DA	1	2,310
Cabinet for Disk Drive	DEC	H9642-DD	1	1,570
Display Terminal	Tektronix	4012	1	5,365
Hard Copy Unit	Tektronix	4611	1	3,940
Digital Plotter	ZETA	8	1	5,950.
Oscilloscope	Tektronix	2445	1	3,240.
Multimeter	Beckman	3030	1	260.
Lab Tool Kit	Jensen	JTK-27/37H	1	1,310.
Tape Cleaner	Computer Link	1022-1	1	4,340.
Terminal Paper			40 cartons	840.
Magnetic Tape, 2400 ft, 10.5 inch			400 reels	4,460.

ITEM	SUPPLIER	MODEL	QTY	EST. TOT
UPS Power Subsystem with batt.	La Marche	8 KVA	1	US$24,5
Spare Parts (Lists to be provided by DEC)	DEC			50,0
Flatbed Digital Plotter	Tektronix	4662	1	4,1
Tape Storage Rack, 3000 reel	Tab Products		1	2,2
Display Terminal w/32K Memory	Tektronix	4112	1	8,0
				US$234,6